

MANAGING WESTERN JUNIPER FOR WILDLIFE¹

Rick Miller

SUMMARY

As woodland succession advances towards mature juniper woodlands, wildlife habitat changes for a wide array of species. It is important to identify both the type of site and stage of woodland development when considering management strategies and evaluating wildlife habitat values. If woodlands are allowed to fully develop plant diversity, structural diversity, berry production, and the opportunity to burn greatly decrease. Maintaining a balance between juniper trees with other plant forms such as shrubs, grasses, and wildflowers will provide the greatest opportunity for the maximum number of wildlife species at the community level. At the landscape level the greatest diversity of wildlife species will occur where there is a mosaic of communities in various stages of succession.

INTRODUCTION

Throughout the West, one of the most pronounced plant community changes in the 20th century has been the expansion of juniper and pinyon-juniper woodlands. These arid woodlands occupy over 42 million acres in the western United States. Western juniper (*Juniperus occidentalis* ssp. *occidentalis* Hook.) occupies approximately 5 million acres in eastern Oregon, 3 million acres in northeastern California, and approximately ½ million acres in northwestern Nevada and southwestern Idaho. Its northern most distribution is represented by a few stands in southeastern Washington.

Western juniper has rapidly expanded into neighboring plant communities during the past 120 years. As woodland succession advances towards mature juniper woodlands, wildlife habitat changes for a wide array of species. It is important to identify both the type of site and stage of woodland development when considering management strategies and evaluating wildlife habitat values.

JUNIPER ECOLOGY

In the Oregon high desert and south to Susanville, California, juniper trees older than 130 years are typically found on rocky surfaces and ridges where fuels from understory vegetation are limiting. These stands are typically open with widely scattered trees. In the pumice sand region just east of the Cascades, ancient woodlands characterize portions of the landscape. These intermittent old growth woodlands are distributed from the Connley Hills near Silver Lake north to the Bend area. The majority of these old stands are relatively open with tree canopy cover typically ranging between 5 and 15%. Old growth juniper trees can exceed 1,000 years of age and remain standing for hundreds of years after death. However, an estimated 97% of western juniper trees in

¹ Draft, to be published in the Woodland Fish and Wildlife Project Publication, World Forestry Center, Portland OR.

eastern Oregon have established since the 1870s. Excessive grazing, reduced role of fire, and the alteration of plant community structure (the increase in shrub cover provides ideal sites for juniper establishment) in the late 1800s were the predominant factors initiating the rapid expansion of western juniper in the Pacific Northwest. The expansion of western juniper was further accelerated by wetter than average conditions between 1870 and 1915. The reduced role of fire and the increase in shrubs have allowed western juniper to readily encroach into many plant communities throughout its range. Plant communities most affected are mountain big sagebrush-bunchgrass, low sagebrush, aspen groves, and mountain mahogany located below 7,000 ft. Juniper is also expanding into riparian communities.

Female flowers are pollinated early in the spring by male cones developed during the previous growing season. Female cones (berries) grow to full size the first year, reach maturity the second year, and fall off during the second autumn and winter. Seeds are primarily dispersed by birds. Seeds are also spread across the landscape by rabbits, coyotes, and water flowing across the land surface. Trees typically reach full reproductive potential between 50 and 70 years of age and remain productive at very old ages. Seeds may remain dormant, germinating over a period of several years as cool moist conditions occur. The majority of successful seedling establishment occurs beneath sagebrush and other shrubs, which serve as nurse plants.

During the early stages of woodland development, juniper adds structural diversity to shrub steppe community types. As woodlands mature, the shrub layer dies out. Depending on the soils, grasses and wildflowers may or may not be lost in the understory. A good cover of grasses usually persists beneath a fully developed woodland on deep well-drained soils. This most often occurs on sites where Idaho fescue dominates the understory. However, the grass and wildflower layer is usually lost on soils with cemented hardpans at 24 inches or less in depth. This frequently occurs on south slopes occupied by Thurber needlegrass. Accelerated soil erosion can become a severe problem on these sites during the late stages of woodland development. Losses in mountain mahogany, bitterbrush, and aspen also occur as juniper gains dominance in these communities.

Although plant species and structural diversity increase during the early stages of juniper encroachment, diversity declines during the late stages of woodland development. The greatest structural diversity typically occurs during the mid phase of woodland succession where the shrub steppe component still remains intact. The successional stage of juniper woodlands in a mountain big sagebrush community type can be identified using the characteristics described in Table 1 (see page 14). Significant reductions in the shrub layer begin when the tree canopy reaches about 1/3 of full potential for the site. Juniper cover in closed woodlands (where juniper cover and density have reached full potential for the site) typically ranges from 25% in south aspect mountain big sagebrush communities to over 60% on north slopes with deep soils. Maximum juniper canopy cover in aspen communities approaches 90%.

WILDLIFE AND JUNIPER

Limited work in juniper woodlands has been conducted evaluating the relationship of wildlife species, particularly non-game species. In addition, much of the work did not quantify woodland composition and structure and ignored the stage of woodland succession. Over 100 wildlife species have been reported to use open juniper woodlands in eastern Oregon for thermal and hiding cover, nesting, and food. However, the amount of tree canopy and composition of the understory greatly affects the suitability of habitat for wildlife and thus influences species composition and abundance. Wildlife diversity in juniper communities is strongly related to the diversity and abundance of understory plant species. Animals often have a narrower adaptation to plant structure (e.g. the number of layers of vegetation present in a community such as trees, shrubs, tall grasses, short grasses, and mosses) than plant food species. For example, vertical layers of vegetation have been closely related to avian diversity. Open juniper woodlands have the greatest potential for maximum structural diversity with all layers present. However, as the tree canopy closes and juniper dominates the site the shrub layer is lost. Depending on the site and soils, the grass and wildflower layer may also be lost or greatly reduced. Juniper berry production, an important mast crop for many wildlife species, is also significantly reduced as woodland succession proceeds to stand closure. Open woodlands of today, which provide important habitat for many wildlife species, become less diverse as woodland succession continues to stand closure. Resource managers need to be aware of the dynamics of juniper woodland communities and develop long range plans to meet the desired objectives on a landscape level.

Large Herbivores

The amount of juniper cover, tree canopy depth, tree height, and stem density have been found to moderate severe winter conditions. In south central Oregon, woodlands that had 30% tree canopy, tree heights 15 ft tall, and 13 mature trees per acre reduced temperature severity, wind, and snow cover during the winter. Deer were observed to occupy these woodlands sites during severe winter conditions although food resources were limited. Survival rates of deer fawns were also greater during severe winter conditions in these woodlands that provided adequate thermal cover. However, woodlands that provide thermal cover typically offer little food for wildlife, or shrub cover for smaller species and poor cover for fawning. In eastern Oregon, optimal deer fawning habitat is characterized by a dense shrub layer (near 40%), typically found on productive north slopes with less than 5% juniper cover. Food plants are also generally more nutritious growing in open sunlight than under shady conditions created by dense tree canopies.

Little work has been done evaluating the relationship of other large wild herbivores with juniper. Antelope have been observed passing through open stands of juniper but typically prefer open shrub grassland communities. Their sense of security generally decreases as canopy height and density increases. Elk have been also observed in open woodlands. However, treatments that reduce conifer canopy densities and cover

typically increase elk densities. Big horn sheep also generally prefer open habitats and are not a juniper obligate. They have, however, been observed to use juniper for shade during hot summer days on Hart Mountain.

Birds

Although a wide variety of birds utilize juniper communities, limited work has been done relating the successional stage or density of trees to bird diversity and abundance. Open juniper woodlands with understory diversity provide good habitat for ground, shrub, and tree nesting birds. However, in closed juniper woodlands, ground and shrub nesting birds are generally absent or present in very low numbers. The greatest avian use in closed woodlands generally occurs at the edge where the woodland adjoins other plant communities. Avian diversity and abundance can be very high in healthy shrub communities lacking trees. However, as trees establish in shrub steppe communities new species such as mountain chickadees, Oregon juncos, and chipping sparrows begin using these communities. The greatest avian diversity in the semiarid uplands typically occurs in these open juniper communities where the shrub, grass, and forb understory are still intact. As tree dominance increases and the shrub layer declines, populations of such birds as sage grouse, green-tailed towhee, western meadow lark, sage thrasher, and vesper, Brewers, and sage sparrows decline.

Juniper berries provide important food for a number of bird species, especially during the winter. Juniper berries are readily consumed by Townsend solitaires, American robins, mountain blue birds, cedar waxwings, Steller's jays, and scrub jays. Ripe juniper berries are an important source of energy containing 46% carbohydrate and 16% fat. During the winter, solitaires and robins consume over 200 berries per day.

Trees less than 100 years old rarely provide cavities. Old growth juniper stands can provide a good source of cavities for nesting birds. Cavities are most often observed in trees over 350 years old. Snags also provide a good source of cavities. Snag densities are usually low in old growth stands and absent in young stands because of very low tree mortality. Snag density in old growth stands in the pumice region is highly variable, typically averaging less than 3 per acre for trees greater than 14 inches in diameter. Dead trees can remain standing for up to 600 years.

Small Mammals

Both diversity and abundance of small mammals are closely correlated with the composition and structure of the tree understory. However, several species such as the pinyon mouse and woodrat are closely tied to juniper. Berries also provide a food source for some small mammals such as rabbits. Increases in small mammal populations, including the desert cottontail, have been reported following the cutting of juniper trees where the slash was left on the ground. The response of small mammal abundance and diversity is also closely linked to the response of shrubs, grasses, and wildflowers following juniper thinning or clearing. Seed production of understory plants usually increases following the reduction of the tree overstory, providing food for both small

mammals and birds. As small mammal abundance increases so does food opportunities for raptors. Downed logs, which provide additional structure used by small mammals are uncommon in undisturbed juniper stands less than 130 years old and typically occur in very low densities in old growth stands.

Amphibians and Reptiles

We probably know the least about amphibian and reptile use in juniper woodlands. Fifteen reptiles and two amphibians species have been reported in communities containing western juniper. However, the presence of rock outcrops, ant mounds, and other site characteristics appear to have a stronger influence on the abundance and diversity of reptiles and amphibians than the presence or absence of juniper. In old growth stands we have observed a high frequency of use by the western fence lizard of juniper logs.

MANAGEMENT

The key to managing juniper for wildlife is not to totally remove it but to maintain a balance of juniper trees with other plant forms such as shrubs, grasses, and wildflowers. Two commonly used tools for managing juniper communities are fire and cutting. In the past, chaining was also a common practice for killing juniper trees but is now cost prohibitive. This technique requires two D-8 caterpillar tractors and 200 to 500 ft of ship anchor chain. The Division of Wildlife in Utah still uses a combination of chaining and seeding in pinyon-juniper woodlands to enhance big game habitat on their lands. Chemical control of western juniper has generally had mixed results and has been little used over the years. The best management tool or tools used for juniper woodland management depends on: (1) site potential and soils, (2) condition of the site, (3) stage of woodland development, and (4) objectives.

Managing for Structural Diversity

Managing juniper woodlands for wildlife should be considered at both the community and landscape levels. Landscapes, composed of a mosaic of plant communities, may be defined at different scales, including regional, a specific watershed, or a portion of a watershed. Maximum wildlife diversity at the community level will occur in juniper woodlands maintained in an open state with good shrub and herb cover. This can be accomplished by maintaining 5 to 12 full size trees per acre or tree canopy cover at less than 10%. On less productive sites, such as south slopes, less than 5% tree canopy cover should allow for vigorous understory growth. Thinning juniper to these levels can enhance bitterbrush leader growth two to four fold compared to growth under nearly closed juniper woodlands. When thinning a stand, old growth trees should be left. Open stands, where trees are not in competition with one another, will increase the potential for maximum berry crops, although such production is highly weather dependent.

At the landscape level, the composition, size, and shape of juniper woodlands and other plant communities greatly influence many wildlife species. How juniper woodlands fit into this mosaic of surrounding communities should be considered when developing management plans. For example, in one of our study sites in south central Oregon mountain bluebird densities were greatest where shrub communities were adjacent to old growth juniper woodlands.

Juniper Management on Good Condition Sites

Managing sites with an intact understory of native plant species provides a great opportunity for manipulating plant community structure and composition for optimal wildlife use. Fuel levels are typically sufficient on these sites, with the exception of low sagebrush communities, to allow the use of fire. Plant communities with a good composition of perennial native plants typically respond very well after fire. Grasses may or may not increase immediately following fire depending on the species present. Perennial forbs typically increase two to four fold. Native annual forbs also usually increase after fire. However, perennial forbs and shrub species with growing points above the ground will be significantly reduced by fire. Examples of fire sensitive species are mat forming forbs such as phlox, buckwheat, and sandwort, and shrubs such as sagebrush, bitterbrush, and mountain mahogany. In the absence of fire these shrubs will slowly decline as juniper woodland development approaches stand closure. At the landscape level, a mosaic of burn and unburned patches increases the overall diversity at this larger scale. Abundance and diversity of wildlife species is often similar between adjacent burned and unburned plant communities. However, wildlife species composition is usually different between burned and unburned communities, increasing the overall diversity of wildlife at the landscape level.

Fire prescriptions can determine the intensity of the fire, which will in turn influence the amount of area left unburned. There is more opportunity to create a mosaic under prescribed fire than under wildfire conditions. Juniper trees 10 ft tall or less are most susceptible to fire. However, the composition and structure of fuels and severity of environmental conditions at the time of the burn will determine tree mortality. The primary advantage of fire is that it can be an economical way of treating large areas. It is also a natural process that occurred prior to Eurasian settlement across many of these landscapes. The greatest disadvantage of using fire, particularly for private landowners, is liability. In addition, burning small units less than several hundred acres is both expensive and places the communities at risk from over grazing by domestic and wild herbivores. Cutting is a useful tool when treating smaller land areas, especially where desirable fire sensitive species such as bitterbrush are present in the understory. Cutting is selective, allowing the landowner to thin to the desired tree density and leave trees such as old growth or female trees for berry production. Liability is also low, but cutting is expensive and not practical for treating large areas.

Juniper Management on Poor Condition Sites

Communities in poor condition generally should not be burned. Fire typically can cause further degradation of these sites through increasing the dominance of exotic plants and bare ground. In addition, fuel is often not sufficient to use fire as a tool. However, under extreme climatic conditions crown fires can sweep across these communities especially if cheatgrass and/or medusahead are abundant in the understory. These exotic species will quickly reestablish following fire. As a rule of thumb invasion of exotic species is a greater threat below 5,000 ft elevation; above 5,000 ft native species are generally more competitive than these introduced Mediterranean annuals.

Cutting juniper can be used to help restore the condition of sites that have lost the majority of the understory cover and have large bareground interspaces between the trees, which make them highly susceptible to erosion. Cutting the trees and spreading the limbs across the surface creates ground cover that protects the soils from erosion, provides sites for seedling establishment of understory plants, and furnishes cover for wildlife. A minimum of two desirable perennial grasses or forbs per 10 ft² are necessary for restoring the understory on sites receiving less than 12 inches of annual precipitation. One plant per 10 ft² is usually adequate on sites receiving greater than 12 inches of precipitation. Restoration may be slow especially if undesirable plants such as cheatgrass dominate the understory. If the site has fewer than the required minimum of perennial understory plants the community should be seeded to a desired mix of species adapted to the site. Broadcasting seed directly on the bare soil surface will have little success, however, spreading seed in slash will greatly increase the success of seedling establishment.

The decision to burn or when to burn sites following cutting should be determined by the objectives. Generally the lower the site condition the more important the juniper slash. Burning to reduce new trees establishing on the site probably can be delayed until the trees are approaching a height of 10 ft. However, the response of the understory vegetation and objectives should dictate when and if fire should be used on a site that has been thinned.

Aspen Communities

In the past 100 years in the Pacific Northwest, aspen has steadily declined due to conifer encroachment. In the semi-arid shrub region, western juniper is rapidly invading aspen groves below 7,000 ft. The conversion of aspen groves to western juniper is primarily attributed to the reduced role of fire and to overgrazing by wild and/or domestic large herbivores. Both fire and cutting are effective tools for restoring aspen stands. However, if overgrazing by large herbivores remains a problem the stands will remain at risk. Aspen communities provide considerably greater foraging and nesting opportunities for all types of wildlife than former aspen groves that have become converted to dense juniper. Aspen stands have greater diversity and abundance of insects, and provide a higher quality forage than juniper woodlands. A wildlife species highly dependent on aspen is the red-naped sapsucker.

Other Considerations

On sites where the understory is in very poor condition the question should be asked if the poor health of the understory is due to the increase in juniper dominance, past and or current management practices, or a combination of both. If current practices such as grazing are a problem, thinning juniper trees will not restore the site. Grazing management should be based on maintaining a healthy stand of plants and a healthy functioning watershed. Grazing management should focus on minimizing soil loss and enhancing infiltration rates. It should also focus on allowing plants to capture sufficient water, nutrients, and sunlight, and retain sufficient plant cover and litter to protect both plants and soils. Sites in poor condition that have been thinned should not be grazed, and managed as a new seeding. The number of years of deferment will depend on the condition of the site prior to treatment and weather conditions in subsequent years following treatment. The response of the plant community in the years following treatment will provide the best indicator as to when to begin grazing.

Water

Water is frequently limiting for wildlife in many juniper communities. Making water available can greatly increase wildlife use of open juniper communities. This is particularly true in the pumice region where surface water is scarce. Guzzlers are an effective tool for increasing the availability of water for wildlife.

CONCLUSIONS

Maintaining a balance of juniper trees with other plant forms such as shrubs, grasses, and wildflowers will provide the greatest opportunity for the maximum number of wildlife species at the community level. At the landscape level the greatest diversity of wildlife species will occur where there is a mosaic of communities in various stages of succession. Shrub communities should be managed for various successional stages from early grassland communities, which follow a fire, to shrub grassland to open mid-successional juniper communities. However, once the woodlands have succeeded to the late or closed stages of development, plant diversity, berry production, and the opportunity to burn have greatly decreased. The expense of cutting also increases with increasing tree density and tree size. In some cases a limited amount of dense closed woodlands forming corridors or small islands may be the desired objective. To minimize the risk of soil loss, management of these dense stands should be on deep well drained soils where an adequate herb layer can persist. However, the majority of these shrub steppe landscapes, which were open prior to the time of settlement, should be managed in a more open state.

Reading Reference List

- Dealy, J.E., D.A. Leckenby, and D.M. Concannon. 1981. Wildlife habitats in managed rangelands – The Great Basin of southeastern Oregon: plant communities and their importance to wildlife. USDA Forest Service General Technical Report PNW-120.
- Leckenby, D.A. and A.W. Adams. 1986. A weather severity on mule deer winter range. *Journal of Range Management* 39:244-248.
- Maser, C., J.W. Thomas, and R.G. Anderson. 1984. Wildlife habitats in managed rangelands – the Great Basin of southeastern Oregon: the relationship of terrestrial vertebrates to plant communities. USDA Forest Service General Technical Report PNW-172.
- Miller, R.F. and P.E. Wigand. 1994. Holocene changes in semiarid pinyon-juniper woodlands. *BioScience* 44:465-474.
- Miller, R.F. and J.A. Rose. 1995. Historic expansion of *Juniperus occidentalis* (western juniper) in southeastern Oregon. *Great Basin Naturalist* 55:37-45.
- Miller, R.F. and J.A. Rose. 1999. Fire history and western juniper encroachment in sagebrush steppe. *Journal of Range Management*. 59: (in press).

Table 2. Checklist: optimizing wildlife habitat in juniper woodlands.

<p><i>Site</i></p> <p>a. Identify the stage of woodland development (see Table 1, pg. 14).</p> <p>b. Identify the plant community and condition.</p>
<p><i>Thinning</i> to maintain mid successional stage woodland development:</p> <p><u>Benefits</u> – retains understory shrubs and herbs and potential berry crops; increases growth of desirable shrubs such as bitterbrush and mountain mahogany; maintains the health of old trees; increases ground cover reducing overland flow and increasing infiltration rates.</p> <p>a. Retain old growth juniper trees.</p> <p>b. Thin to approximately 5 to 12 full size trees per acre or less than 10% tree canopy cover; 5% or less tree cover on less productive sites. On poor condition sites – cut and spread limbs across the site to increase ground cover to enhance site restoration.</p> <p>c. Broadcast seed beneath slash on sites with less than two desirable perennial plants/10 ft² (1/10 ft² where annual precipitation is greater than 12 inches).</p> <p><i>Burning</i></p> <p>a. Burning should not be considered (and is probably not practical) on sites lacking desirable understory shrubs and herbs and dominated by introduced annuals such as cheatgrass and medusa-head.</p> <p>b. Burning should be considered where sites are in good condition, adequate fuel is available, the threat of exotic annuals is low, and large land areas need to be treated.</p>